



## Environmental footprint of cooking fuels: A life cycle assessment of ten fuel sources used in Indian households

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### Abstract:

**Purpose:** Cooking energy is an essential requirement of any human dwelling. With the recent upsurge in petroleum prices coupled with intrinsic volatility of international oil markets, it is fast turning into a politico-socio-economic dilemma for countries like India to sustain future subsidies on liquefied petroleum gas (LPG) and kerosene. The aim of this paper is to evaluate and compare the environmental performance of various cooking fuel options, namely LPG (NG), LPG (CO), kerosene, coal, electricity, firewood, crop residue, dung cake, charcoal, and biogas, in the Indian context. The purpose of this study is to find environmentally suitable alternatives to LPG and kerosene for rural and urban areas of the country.

**Methods:** The study assessed the cooking fuel performance on 13 ReCiPe environmental impact categories using the life cycle assessment methodology. The study modeled the system boundary for each fuel based on the Indian scenario and prepared a detailed life cycle inventory for each cooking fuel taking 1 GJ of heat energy transferred to cooking pot as the functional unit. **Results and discussion:** The cooking fuels with the lowest life cycle environmental impacts are biogas followed by LPG, kerosene, and charcoal. The environmental impacts of using LPG are about 15 to 18 % lower than kerosene for most environmental impact categories. LPG derived from natural gas has about 20 to 30 % lower environmental impact than LPG derived from crude oil. Coal and dung cake have the highest environmental impacts because of significant contributions to climate change and particulate formation, respectively. Charcoal produced from renewable wood supply performs better than kerosene on most impact categories except photochemical oxidation, where its contribution is 19 times higher than kerosene. **Conclusions:** Biogas and charcoal can be viewed as potentially sustainable cooking fuel options in the Indian context because of their environmental benefits and other associated co-benefits such as land farming, local employment opportunities, and skill development. The study concluded that kerosene, biogas, and charcoal for rural areas and LPG, kerosene, and biogas for urban areas have the lower environmental footprint among the chosen household cooking fuels in the study.

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### Resource Description

#### Exposure : ☐

weather or climate related pathway by which climate change affects health

Air Pollution, Ecosystem Changes, Food/Water Quality, Indoor Environment, Unspecified Exposure

**Air Pollution:** Ozone, Particulate Matter, Other Air Pollution

# Climate Change and Human Health Literature Portal

**Air Pollution (other):** CO; NOx; VOC; SO2

**Food/Water Quality:** Other Water Quality Issue

**Water Quality (other):** Eutrophication

**Geographic Feature:** 

resource focuses on specific type of geography

Rural, Urban

**Geographic Location:** 

resource focuses on specific location

Non-United States

**Non-United States:** Asia

**Asian Region/Country:** India

**Health Co-Benefit/Co-Harm (Adaption/Mitigation):** 

specification of beneficial or harmful impacts to health resulting from efforts to reduce or cope with greenhouse gases

A focus of content

**Health Impact:** 

specification of health effect or disease related to climate change exposure

General Health Impact

**Mitigation/Adaptation:** 

mitigation or adaptation strategy is a focus of resource

Mitigation

**Resource Type:** 

format or standard characteristic of resource

Research Article

**Timescale:** 

time period studied

Time Scale Unspecified

**Vulnerability/Impact Assessment:** 

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

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